

CR-131154

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FOURTH BIMONTHLY PROGRESS REPORT

UNIVERSITY OF ALASKA

ERTS PROJECT NO. 110-8

March 29, 1973

A. TITLE OF INVESTIGATION: Sea Ice and Surface Water Circulation,
Alaskan Continental Shelf

B. PRINCIPAL INVESTIGATOR/GSFC ID: G. D. Sharma, F. F. Wright and
J. J. Burns/UN683

C. PROBLEMS IMPENDING INVESTIGATION: None

D. PROGRESS REPORT:

1. Accomplishments during reporting period: Water samples from 45
stations in the Gulf of Alaska and at the mouth of Copper River were
obtained to determine suspended load distribution in this area. Temperature
and salinity of waters were also determined to delineate surface water
circulation in this region. The oceanographic data was collected at no
cost to the project.

Investigations of sea ice characteristics, distribution of ice
types, formations and disintegration patterns, and direction and rate
of movement of ice are underway in the Bering, Chukchi, and Beaufort seas.
At present only limited data are available from the period between
1 August and 18 October, 1972.

Original photography may be purchased from:
EROS Data Center
10th and Dakota Avenue
Sioux Falls, SD 57198

N73-20378

Unclas
00416

G3/13

(E73-10416) SEA ICE AND SURFACE WATER
CIRCULATION, ALASKAN CONTINENTAL SHELF
Bimonthly Progress Report (Alaska Univ.,
Fairbanks.) 18 p HC \$3.00 CSCI 08L

During this period the geographical area of interest was essentially ice free. However, excellent although limited imagery was available on 2 August and 18 October, 1972. The analysis of data confirmed applicability of ERTS imagery to determine ice conditions prevailing during the critical period of February through July, 1973.

2. Plans for next reporting period: Plans are made to collect ground truth from Cook Inlet during the ERTS-1 satellite passes of March 27-28, April 14-15, and May 2-3, 1973. Density slicing on the available imagery will be performed to establish correlation between ground truth and the ERTS-1 images.

Extensive studies of sea ice are anticipated during the period of February through July, 1973. The season is known to include: 1) period of near maximum ice coverage; 2) period of most stable late-winter ice conditions (extremely important from the standpoint of mammal ecology); 3) initial period of disintegration and northward retreat of sea ice (directly influencing distribution and movements of marine mammals); and 4) the advanced stages of ice disintegration.

Low level aerial photographs obtained by NASA flights over the Bering Sea synchronous to the ERTS-1 imagery (approximately 15 February through 6 March 1973) are available and will serve as ground truth data.

The sea ice studies have been conducted at no cost to the project.

- E. SIGNIFICANT RESULTS: See separate pages.
- F. PUBLICATIONS: None
- G. RECOMMENDATIONS: None
- H. CHANGES IN STANDING ORDER FORMS: None
- I. ERTS IMAGE DESCRIPTOR FORMS: Forms Attached
- J. DATA REQUEST FORMS: None

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March 29, 1973

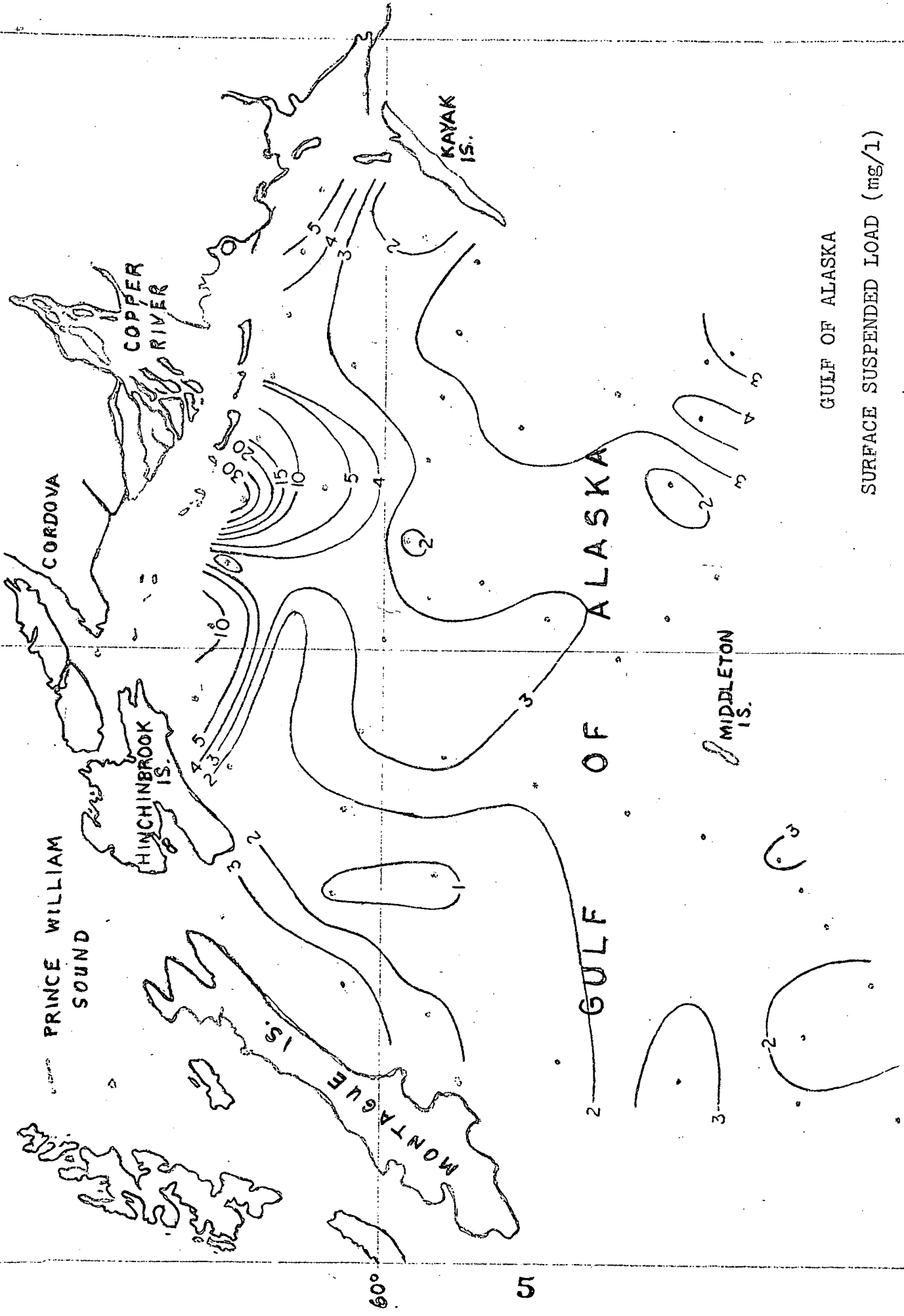
PRINCIPAL INVESTIGATOR: G. D. Sharma, F. F. Wright, and J. J. Burns

TITLE OF INVESTIGATION: Sea Ice and Surface Water Circulation,
Alaskan Continental Shelf.

~~DISCIPLINE: Marine Geology and Ecology~~

~~SUMMARY OF~~ SIGNIFICANT RESULTS:

The oceanographic data obtained from the Gulf of Alaska during February 21-24, 1973, were correlated with ERTS-1 imagery ID 1081-20284 (figs. 1, 2, 3, 4, 5, and 6). Sediments contribution of the Copper River is carried westward along the shore as a distinct plume. Oceanic water relatively poor in suspended sediments appears to intrude near Montague Island and is discernible in ERTS-1 imagery. The turbid water observed between Middleton Island and Kayak Island is result of Ekman transport and generally controlled by meteorological processes. A distinct anticlockwise surface water circulation is prevalent in this region.

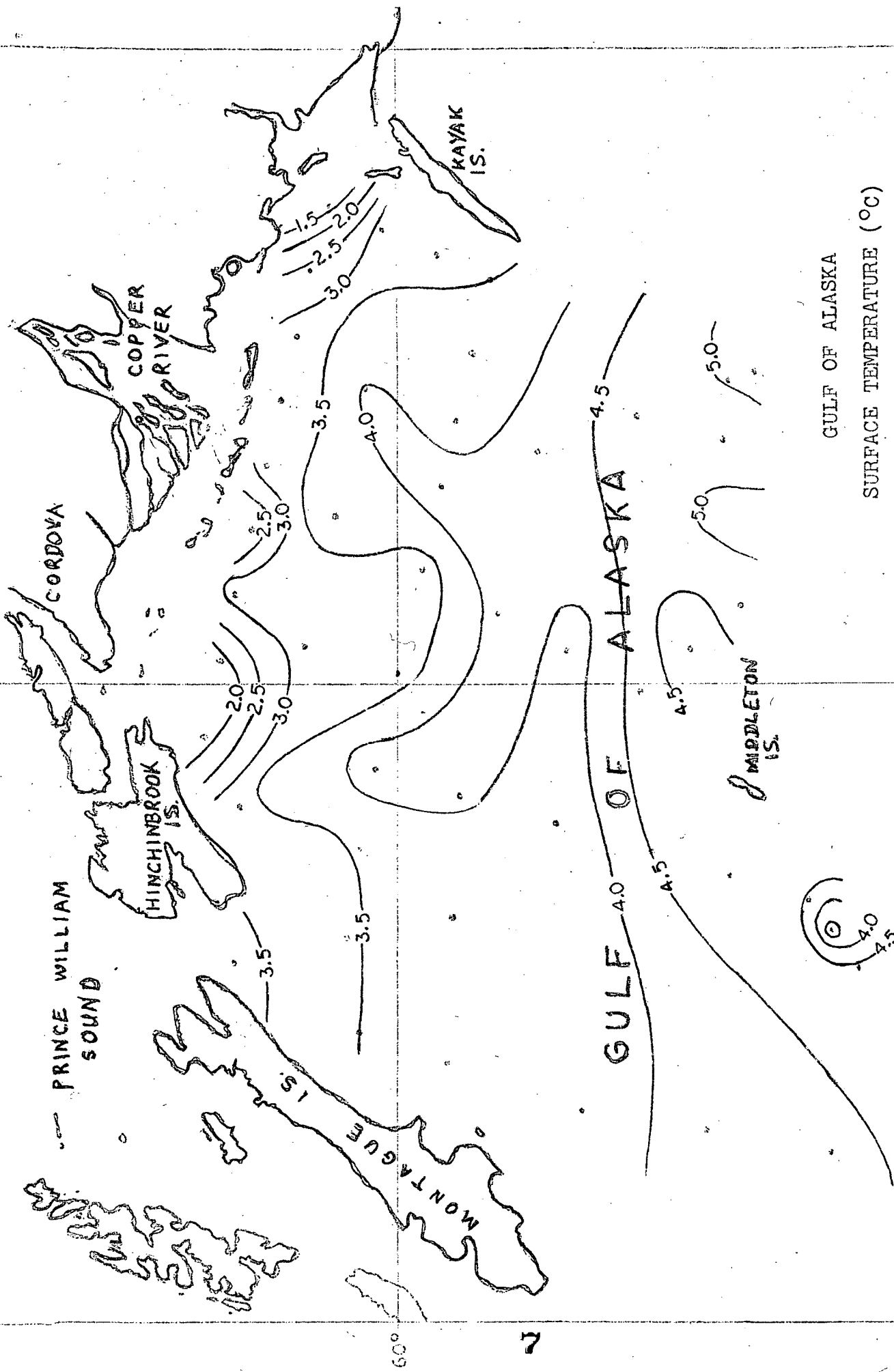


GULF OF ALASKA

SURFACE SUSPENDED LOAD (mg/l)

21-24 FEBRUARY 1973

Figure 1. Surface suspended load distribution in Gulf of Alaska



GULF OF ALASKA
SURFACE TEMPERATURE (°C)

21-24 FEBRUARY 1973

Figure 3. Surface water isotherms in Gulf of Alaska

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ERTS PROJECT NO. 110-8

March 29, 1973

PRINCIPAL INVESTIGATOR: G. D. Sharma

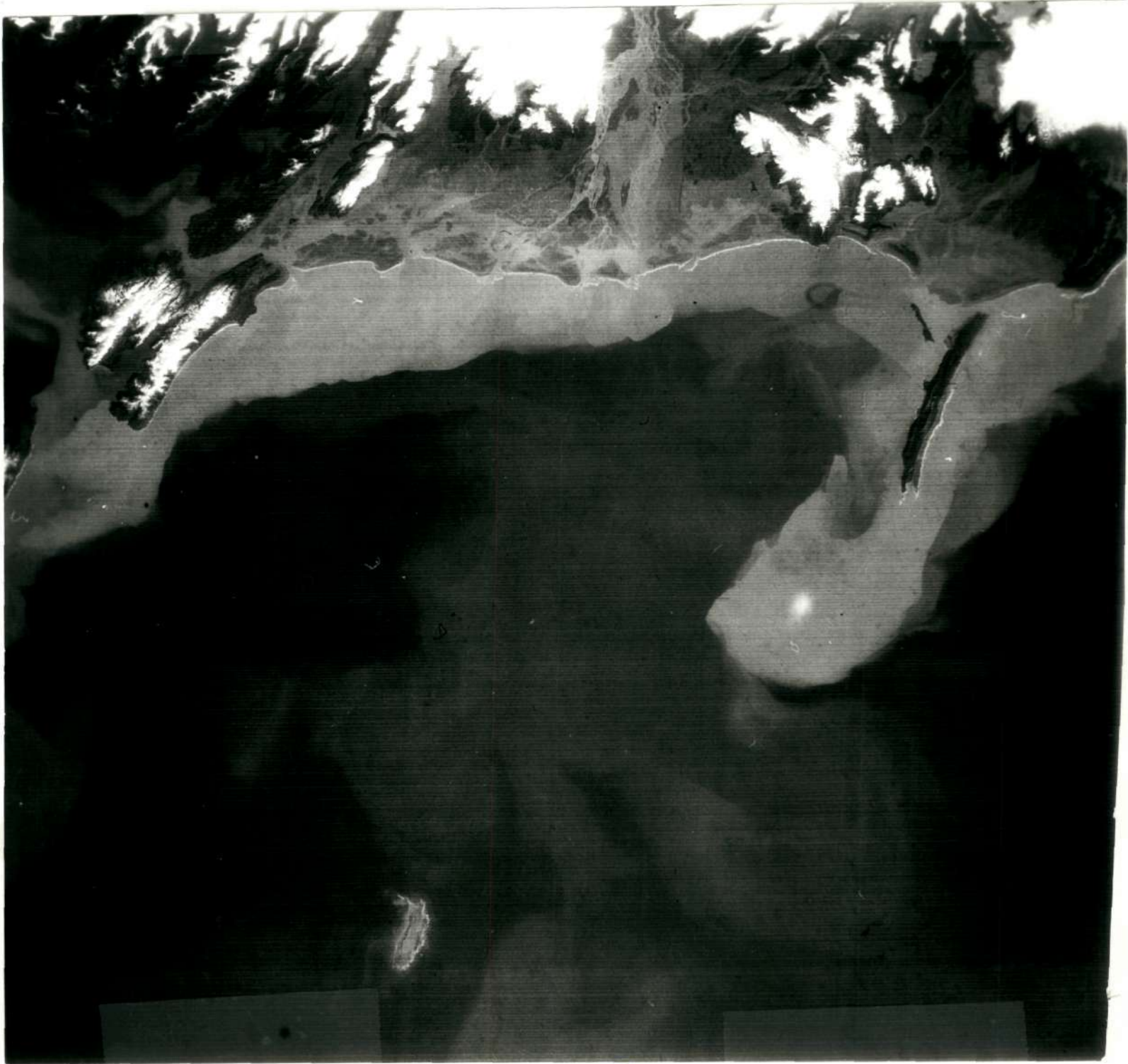
TITLE OF INVESTIGATION: Sea Ice and Surface Water Circulation,
Alaskan Continental Shelf.

DISCIPLINE: Marine Geology and Ecology

SUMMARY OF SIGNIFICANT RESULTS:

Sediments contributed by the Copper River in the Gulf of Alaska are carried westward along the shore as a distinct plume. Oceanic water relatively poor in suspended material appears to intrude near Montague Island, and turbid water between Middleton Island and Kayak Island is result of Ekman transport. An anticlockwise surface water circulation is observed in this region. Ground truth data indicate striking similarity with ERTS-1 imagery obtained on October 12, 1972.

Observations of ERTS-1 imagery reveals that various characteristics and distribution of sea ice in the Arctic ocean can be easily studied. Formation of different types of sea ice and their movement is quite discernible. Sea ice moves parallel to the coast in near shore areas and to the northerly direction away from the coast.



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Figure 4. ERTS-1 image ID 1081-20284 MSS-4 showing distribution of turbid waters



Figure 5. ERTS-1 image ID 1081-20284 MSS-5 showing distribution of turbid waters

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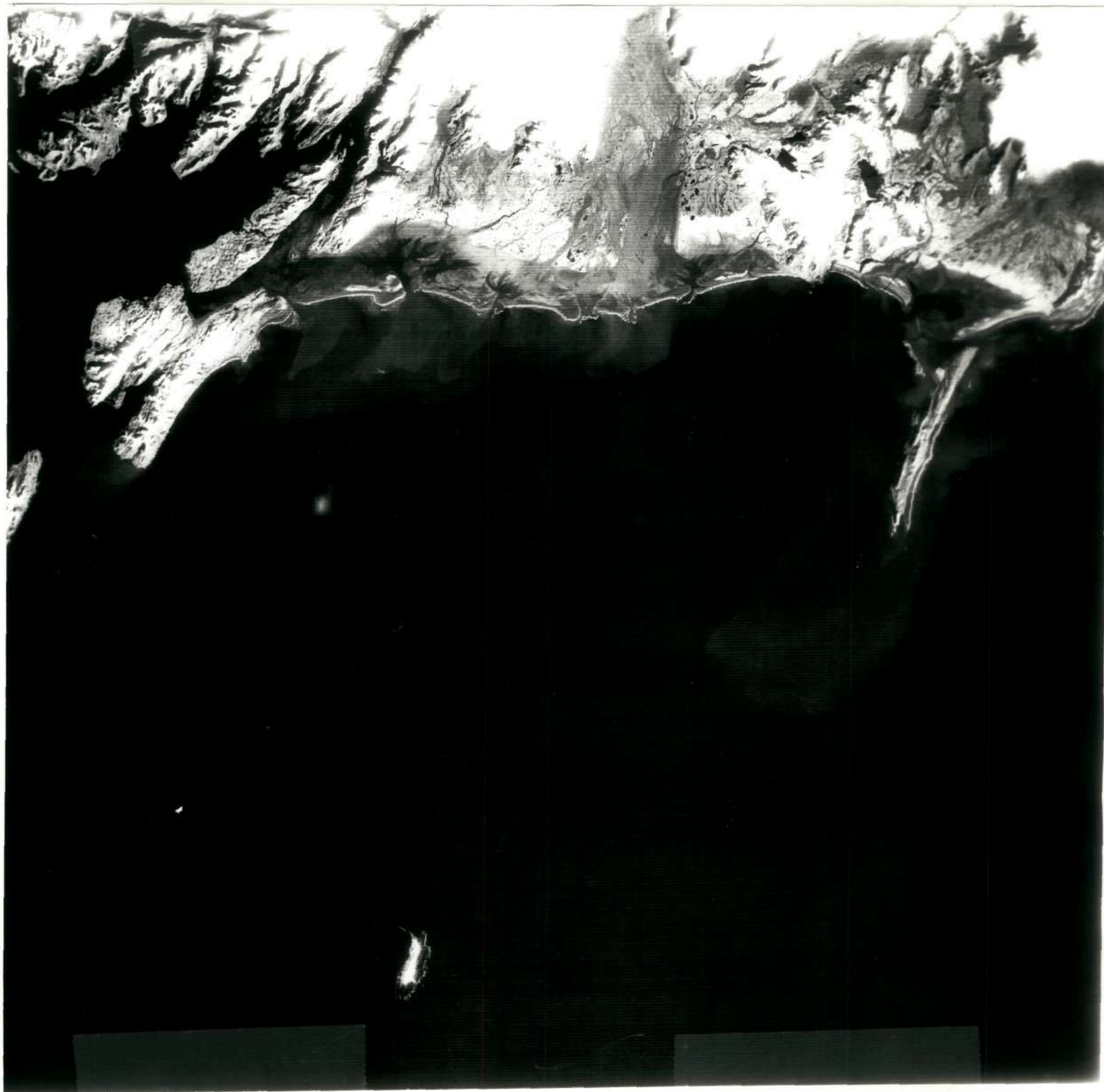


Figure 6. ERTS-1 image ID 1081-20284 MSS-6 showing distribution of turbid water

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The ERTS-1 imagery for ice study is satisfactory. The ERTS-1 image ID. 1010-22135 MSS-5 covers the area along the northwest coast of Alaska showing the prominent landmarks of Ice Cape, Wainwright, and Point Franklin (Fig. 7). The analysis shows (see attached overlay) the southern edge of seasonal sea ice, which is undergoing both rapid deterioration and northward movement in the northwestern corner of the image. Different characteristics of the sea ice are quite discernible and have been delineated on the attached overlay. Measurements of aerial extent of the different ice types were not made, however, the task can be achieved without difficulty. The image shows clearly that most of the snow cover has already melted except on the larger, irregular and rough ice floes. These floes (indicated by the number 5, fig. 7) appear to be remnants of what was formerly heavy, shore-fast ice. It is doubtful that they are floes of multi-year ice, because of their presence in the ice edge, their rough surface sculpture and several other characteristics. Surface water currents, based on the orientation of ice tongues, appear to parallel the coast in near shore areas and to northerly direction away from the coast.

The ERTS-1 image ID 1010-22133 MSS-6 covers the area northwest of Point Franklin which lies adjacent to the image described earlier. Total area covered by drifting ice is much more extensive and provides excellent examples of seasonal ice in the late stages of disintegration (fig. 8).

Although large irregular polynya are obvious, there are no leads characteristics of sea ice during winter and spring. The loose and

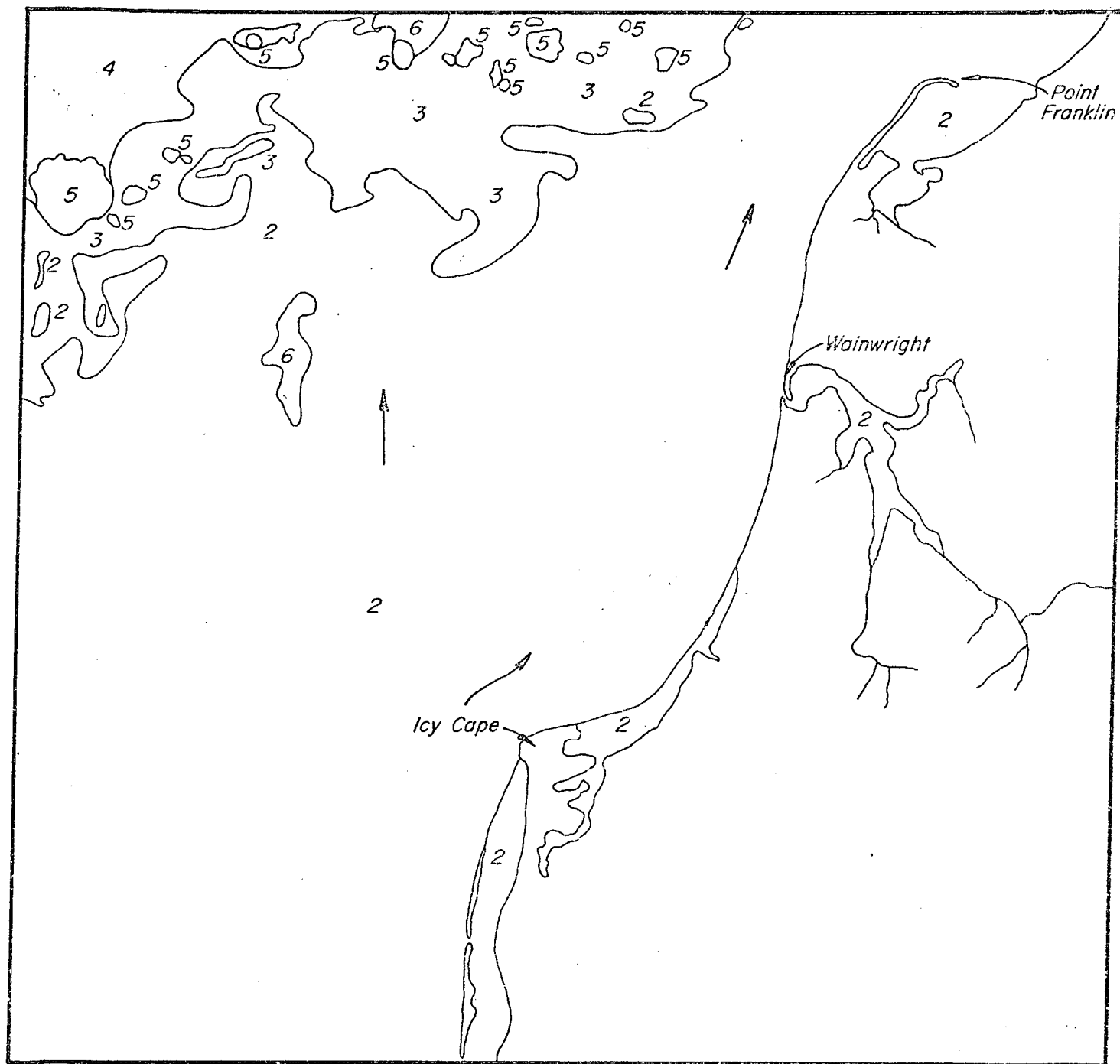


Figure 7. ERTS-1 image ID 1010-22135 MSS-5 with overlay showing characteristics and distributions of various sea ice types in the region of Wainwright, Alaska

- | | |
|--|---|
| 1 - Land | 5 - Individual and relatively heavy floes |
| 2 - Open water (both fresh and salt) | 6 - Clouds |
| 3 - Disintegrating and weathered "ice edge zone" | 7 - Loose and widely scattered floes |
| 4 - Disintegrating and weathered "pack ice zone" | |

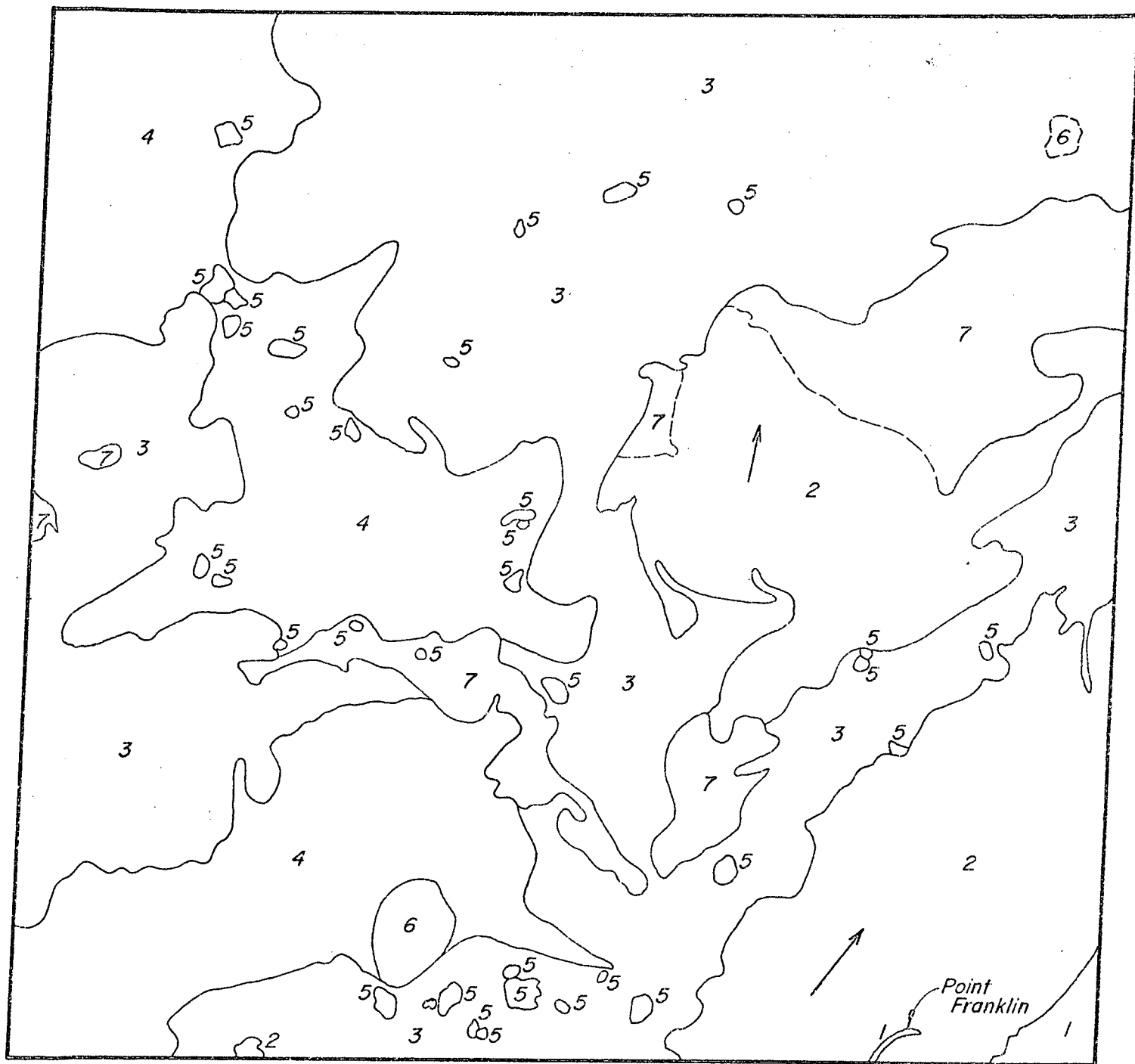


Figure 8. ERTS-1 image ID 1010-22133 MSS-6 with overlay showing characteristics and distribution of various sea ice types in the region of Point Franklin, Alaska

- | | |
|--|---|
| 1 - Land | 5 - Individual and relatively heavy floes |
| 2 - Open water (both fresh and salt) | 6 - Clouds |
| 3 - Disintegrating and weathered "ice edge zone" | 7 - Loose and widely scattered floes |
| 4 - Disintegrating and weathered "pack ice zone" | |

fragmented nature of the ice pack preclude formation of distinct leads, as it is driven by the forces of winds and surface water currents. The almost complete loss of snow cover is especially evident in this image, due to the greater extent of ice cover and therefore the increased opportunity for comparison.

Tonal differences in ice zones are particularly evident as is the actual structure of ice within the zones. This is especially useful in delineating the various zones (see attached overlays). Orientation of ice features again indicate currents parallel to the coast in the near shore areas and more northerly farther off-shore.

ERTS-1 image ID 1087-20595 MSS-5 covers the northern coast of Alaska; Barter Island being the prominent land-head (fig. 9). The image shows the process of ice formation during early fall, and is an excellent example of the detail and fine resolution which can be obtained from ERTS-1 imagery.

At the time this image was taken, the pack ice was approximately 65 to 70 miles north of Barter Island. Active ice formation was occurring in the open ocean and is evident as thin "grease" ice and slightly thicker but unconsolidated "slush" ice. The pattern of surface currents is particularly evident, paralleling the coast in the near shore and consisting of many eddies and gyres further off-shore. The general direction of currents (and ice movement) is toward the west.

Ice cover in the Bering, Chukchi and Beaufort seas results from two major processes which are evident in this image. These are the

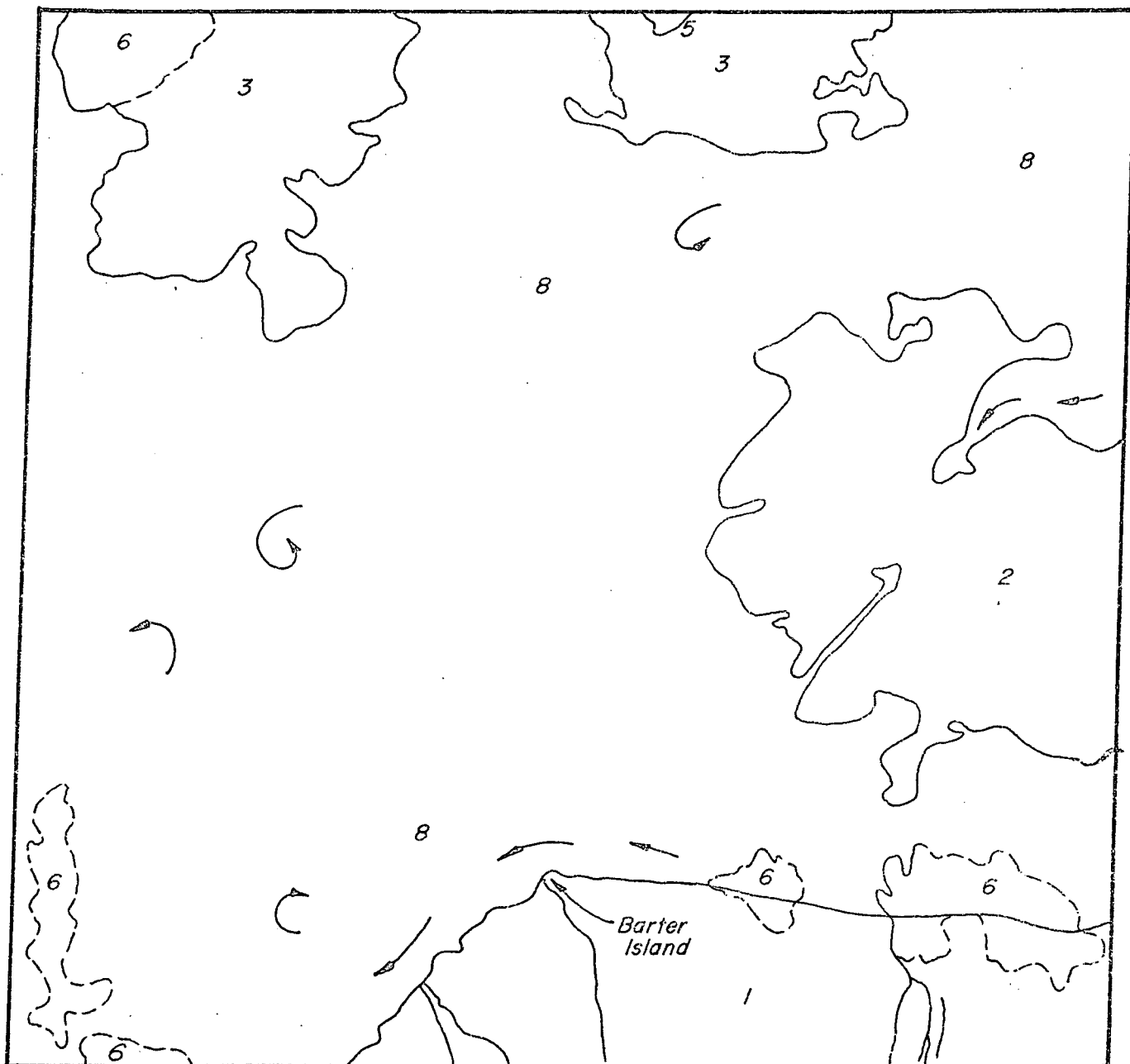


Figure 9. ERTS-1 image ID 1087-20595 MSS-5 with overlay showing characteristics and distributions of various sea ice types in the region of Barter Island, Alaska

- | | |
|---|--|
| 1 - Land covered with snow | 5 - individual and relatively heavy floes |
| 2 - Open water | 6 - Clouds |
| 3 - Edge zone of the pack ice, also covered with snow | 8 - Actively forming, unconsolidate "slush" and "grease" ice |

formation of new ice, more or less in situ, and the movement of previously formed ice into the area.

From the foregoing discussion it is evident that many features of sea ice can be determined from the ERTS-1 imagery. Interpretation of sea ice will be accomplished on all useable images and will be correlated with ground truth data recently obtained by low level NASA flights.

ERTS IMAGE DESCRIPTOR FORM

(See Instructions on Back)

DATE March 29, 1973

PRINCIPAL INVESTIGATOR G. D. Sharma

GSFC UN683

ORGANIZATION University of Alaska

NDPF USE ONLY

D _____

N _____

ID _____

PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			Sediment Plume	DESCRIPTORS	Sea Ice
	Ocean	River	Snow			
ID 1081-20284 MSS-4	x	x	x	x		
ID 1081-20284 MSS-5	x	x	x	x		
ID 1081-20284 MSS-6	x	x	x	x		
ID 1010-22135 MSS-5	x	x	x			x
ID 1010-22133 MSS-6	x		x			x
ID 1087-20595 MSS-5	x	x	x			x

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

MAIL TO ERTS USER SERVICES
CODE 563
BLDG 23 ROOM E413
NASA GSFC
GREENBELT, MD. 20771
301-982-5406

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Image descriptors are only supplied by investigators. An image descriptor is a term which assists in defining the content of an image. All of these inputs will be compiled and entered into the NDPF data base for subsequent investigator query servicing and catalog preparation. A standard vocabulary of image descriptors is included in the Data Users Handbook, Section 4.

Coding for the major portion of this form is straight forward and self explanatory. It should be noted however that it is extremely important to assign the correct product ID to those descriptors that apply to a particular spectral image or a combination of spectral images. Below is a description of the product ID along with tables defining the valid band and product type (processing designator). Your cooperation in providing complete, valid product ID's would be greatly appreciated.

PRODUCT ID

A	D	D	H	H	M	M	S	
1	0	3	7	0	5	1	8	5

SATELLITE NUMBER (1 = ERTS A; 2 = ERTS B)

DAYS SINCE LAUNCH

HOUR OF DAY (GMT)

MINUTES OF HOUR (GMT)

TENS OF SECONDS OF MINUTES (GMT)

"B" CODE SENSOR SPECTRAL BAND DESIGNATOR

B	Band
1	RBV 1
2	RBV 2
3	RBV 3
4	MSS 1
5	MSS 2
6	MSS 3
7	MSS 4
R	All RBV Bands
M	All MSS Bands
X	All Bands

"P" CODE PROCESSING DESIGNATOR (PRODUCT)

P	Processing Type
Blank	Sys. Corr.
A	Scene Corr.
B	Sys. Corr. Color
C	Scene Corr. Color
D	Sys. Corr. Digital
E	Scene Corr. Digital
X	Non Standard Processing

Sys. Corr. - System Corrected Images (Bulk)

Scene Corr. - Scene Corrected Images (Precision)

David Court of Film